

# GERB en CM-SAF status report

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Ocean Aerosol  
Dataset

Sun glint  
correction

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# RMIB GERB Processing

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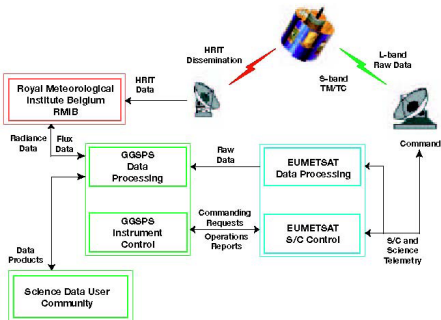
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## Input

- ▶ GERB level 1.5 from RAL
- ▶ SEVIRI level 1.5 from EUM

## Processing

- ▶ LW separation
- ▶ Unfiltering
- ▶ Scene identification + ADM's
- ▶ Various spatial and temporal processing
  - ▶ to combine GERB and SEVIRI
  - ▶ tuning of the geolocation
  - ▶ resolution enhancement

## Output

- ▶ Level 2 solar and thermal fluxes at TOA
- ▶ 3 formats:
  - ▶ ARG: Averaged Rectified Geolocated (45km, 17', no correction of PSF)
  - ▶ BARG : Binned Averaged Rectified Geolocated (45km, 15', PSF corrected)
  - ▶ HR : High Resolution (9km, 15', PSF corrected)

# Near real time GERB/GERB-like processing

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- ▶ Software version V006 operational since 2009/10/23
- ▶ ARG data inspected and renamed to Edition-1 until approx. July 2011
- ▶ NRT data distributed via our FTP server (last 40 days)

```
$ ftp://gerb.oma.be  
$ cd G1/SEV2/G1_SEV2_L20_{format}/{files}
```

- ▶ Full level-2 archive now available on NRT FTP server

```
$ cd Archive/G1/SEV2/G1_SEV2_L20_{format}/YYYY/MMDD/{files}  
$ cd Archive/G2/SEV1/G2_SEV1_L20_{format}/YYYY/MMDD/{files}
```

- ▶ To register go to:

<200f>

<http://gerb.oma.be>

- ▶ Monthly means for CM-SAF  
("express product", not climate quality dataset)

# Near real time GERB/GERB-like processing (bis)

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## Data availability for last 12 months

- ▶ GERB: good except biannual sun avoidance season
- ▶ GERB-like (SEVIRI) : excellent
  - ▶ no decontamination
  - ▶ no MSG failure
  - ▶ only 45 files are missing over 1 year (0.14%) but no "long" interruption.

## Development of RMIB GERB Processing Edition 2

- ▶ Read wavelets compressed SEVIRI data directly.
  - ▶ Allows easier/faster reprocessing.
  - ▶ Interface routines are written and integrated in the processing.
- ▶ Snow in scene ID and radiance to flux conversion
  - ▶ Read the 3900 nm SEVIRI channel.
  - ▶ Snow detection algorithm developed works but additional validation needed.
  - ▶ Snow ADM's of Seiji Kato to be used.
- ▶ Improved NB-to-BB:
  - ▶ Empirical SEVIRI(NB)-to-GERB(BB) regressions have been derived for GERB-2.
  - ▶ Replace the previous theoretical regressions.
  - ▶ Investigations and documentation is done.



# New developments and future work (bis)

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## Development of RMIB GERB Processing Edition 2

- ▶ Improved clear land ADMs.
  - ▶ Preliminary work done
  - ▶ ADM stratified in latitude band of 1 degree.
  - ▶ Solve morning/afternoon asymmetry in ED01 SW flux.
- ▶ Use actual satellite position and quality flags → more accurate viewing geometry.
- ▶ Improve the LW ADM.
  - ▶ better handling of high/thin clouds.
  - ▶ Could be updated using EarthCARE database of TOA radiance fields.
- ▶ Better LW cloud detection (Paper in preparation)
- ▶ Clear ocean aerosol retrieval improvement (see part 3)

## Development of RMIB GERB Processing Edition 2

- ▶ Take into account the change in LW spectral response due to instrument optical path.
- ▶ Use SEVIRI effective radiance instead of spectral radiances.
- ▶ Implement aerosol SW ADM over clear ocean (developed by Helen Brindley).
- ▶ Improved cloud phase.
- ▶ Pixel level processing of solar eclipse
- ▶ Reduce gaps in the GERB-like dataset using images from MSG backup satellite

- ▶ ED01 (or equivalent) dataset now covers 2004 - 2011
- ▶ All data/formats available on our FTP
- ▶ We started the development of Edition-2 of the RMIB GERB Processing.
- ▶ Cloud products: plan to separately archive CM SAF SEVIRI instantaneous cloud products and make those products available to the users with appropriate spatial and temporal processing (HR, BARG).

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- ▶ Proposal accepted by EUM council
- ▶ TOA radiation:
  - ▶ Continue the all sky GERB/SEVIRI monthly means climatology (Total Incoming Solar (TIS), Total Emitted Thermal (TET) and Total Reflected Solar (TRS) radiation)
  - ▶ Reprocess if needed, in particular if GERB Edition-2 available
  - ▶ GERB-like from MVIRI
  - ▶ Generation of monthly means clear sky fluxes
- ▶ Feasibility of an "evapotranspiration" dataset
- ▶ Aerosol retrieval (see part 3)

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# CM-SAF Timeline of Products

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## CDOP 1 (until end 2011)

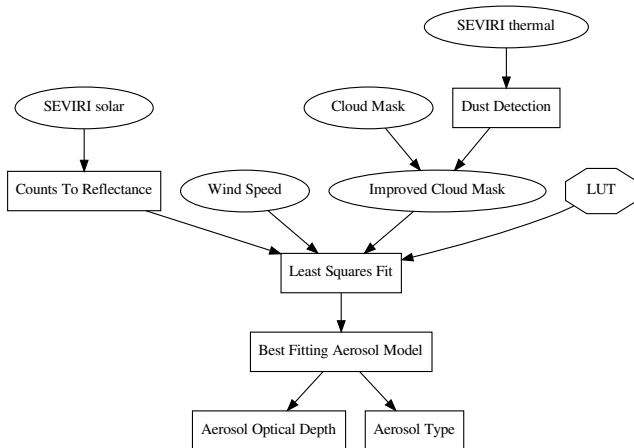
- ▶ Aerosol dataset over ocean using SEVIRI.
- ▶ Aerosol Optical Depth (AOD) and Direct Aerosol (Radiative) Forcing (DAF).

## CDOP 2 (until end 2017)

- ▶ Aerosol dataset over land using SEVIRI.
- ▶ AOD and DAF.
- ▶ Investigation of use of MVIRI to extend dataset in the past.

All products, after + validation → included GERB scene ID.

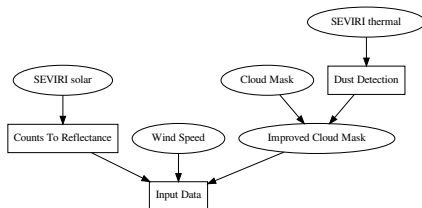
# Flowchart for the Algorithm



Balloons represent on-line data, octagons off-line data and boxes methods.



- ▶ SEVIRI level 1.5 images at wavelengths 600, 800 and 1600 nm (solar) for AOD calculation.
- ▶ The CM SAF cloud mask, based on NWC SAF software.
- ▶ SEVIRI level 1.5 thermal images to mitigate misidentification thick aerosols as clouds.
- ▶ The wind speed over ocean from ECMWF.



Heart of the algorithm: look up tables generated using LIRADTRAN with the following parameters:

- ▶ Wind speed
- ▶ Angles
- ▶ Aerosol type (6)

Convolution with SEVIRI solar channels → LUT for all SEVIRI solar channels.

# LUT Generation: Aerosol Models

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6 aerosol types

- ▶ 3 spherical
- ▶ 3 non-spherical classes

Origin:

- ▶ taken from Govaerts et al. (2010)
- ▶ derived from an analysis of AERONET retrieval.

Reason for choosing these 6 types :

- ▶ enough mutual differences to be used in a minimalization technique (a crucial element in our algorithm)
- ▶ plans to extend the dataset land use using the output of the LDA algorithm from Govaerts et al. (2010) for the estimation of background AOD.

# Least Squares Fit

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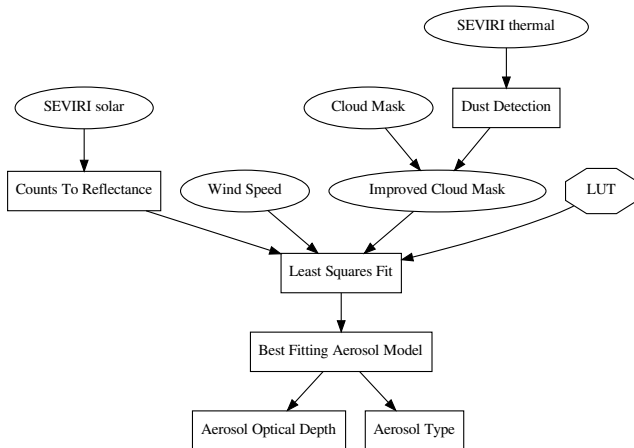
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Balloons represent on-line data, octagons off-line data and boxes methods.

# Least Squares Fit

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- ▶ We do a least squares fit on 6 families of curves.
- ▶ x-axis = wavelength / y-axis = AOD
- ▶ each of the 6 families correspond to an aerosol type
- ▶ each family is parametrized by a continuous variable  
= AOD @ 550nm
- ▶ each family comes from a bigger family with as extra parameters:
  - ▶ wind speed
  - ▶ angular information

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- ▶ Scene identification is unreliable
- ▶ Solution: extrapolate scene ID just before sun glint to sun glint
- ▶ Not an interpolation between pre- and post-glint; it should work in near-real time

# Scene ID extrapolation

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- ▶ Last valid cloud cover, cloud phase & cloud optical depth are stored
- ▶ Do not keep scene ID longer than 2.5 hours
- ▶ Stored scene ID replaced with real scene ID as soon as available
- ▶ Stored data  $> 2.5$  hours invalid
- ▶ Not required over land



# Correcting sun glint

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- ▶  $SGA < 15^\circ$ 
  - ▶ Clear ocean: CERES TRMM climatology (albedo + incoming solar  $\rightarrow$  flux)
  - ▶ Cloudy ocean: radiance-to-flux conversion using extrapolated scene ID
  - ▶ Land: radiance-to-flux conversion
- ▶  $15^\circ < SGA < 25^\circ$ 
  - ▶ Clear ocean: CERES TRMM climatology

Example: 7 July 2004, 14:30

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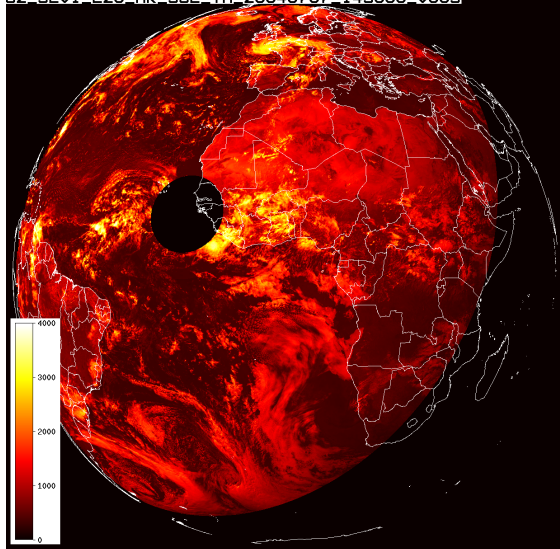
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G2\_SEV1\_L2O\_HR\_SOL\_TH\_20040707\_143000\_V003



Example: 7 July 2004, 14:30

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